CLAIMS

1. An in-line four-cylinder engine for a vehicle including a crankshaft having first crank pins of two cylinders, wherein the first crank pins are provided on a common first virtual plane and are arranged with a 180° phase difference, and having second crank pins of another two cylinders, wherein the second crank pins are provided on a second virtual plane different by a 90° phase from the first virtual plane and are arranged with a 180° phase difference, the in-line four-cylinder engine comprising:

a crankshaft satisfying a formula of

$(k_L - 0.25) \cdot (0.25 - k_R) \cong D_R / D_L$,

wherein, when a crank web for each of at least two cylinders is divided between a pair of half crank webs facing a crank pin, wherein k_L, k_R denote balance ratios of the both half crank webs (wherein $k_L \neq 0.25$, $k_R \neq 0.25$) and D_L, D_R denote distances from the center in a longitudinal direction of the crankshaft to the respective half crank webs, the crank webs for the four cylinders of the engine are set so that a track of a vector of a primary inertial couple is formed into a substantially circular shape; and

a primary balancer for generating a couple vector offsetting a vector of the first inertia couple.

2. The in-line four-cylinder engine for a vehicle

according to Claim 1, wherein $(k_L + k_R)$ for at least a part of the cylinders is less than 0.5.

3. The in-line four-cylinder engine for a vehicle according to Claim 1, wherein $(k_L + k_R)$ for at least a part of the cylinders is more than 0.5.

4. The in-line four-cylinder engine for a vehicle according to Claim 1, wherein two cylinders satisfy a condition in Claim 1 and both of the balance ratios k_L and k_R of the other two cylinders are set at 0.25.

5. The in-line four-cylinder engine for a vehicle according to any one of Claims 1 to 3, wherein the crankshaft has crank pins of the first and fourth cylinders located on the first virtual plane, and crank pins of the second and third cylinders located on the second virtual plane, when the first to fourth cylinders are provided in this order from an end.

6. The in-line four-cylinder engine for a vehicle according to Claim 1, wherein the crankshaft has crank pins of the first and third cylinders located on the first virtual plane, and crank pins of the second and fourth cylinders located on the second virtual plane.

7. The in-line four-cylinder engine for a vehicle according to Claim 1, wherein the crankshaft has crank pins of the first and second cylinders located on the first virtual plane, and crank pins of the third and

fourth cylinders located on the second virtual plane.

8. The in-line four-cylinder engine for a vehicle according to Claim 5, wherein balance ratios k_L and k_R and distances D_L and D_R of half crank webs of the respective cylinders are symmetrical between the first and fourth cylinders and symmetrical between the second and third cylinders.

9. The in-line four-cylinder engine for a vehicle according to Claim 6 or 7, wherein the distances D_L and D_R are symmetrical between the first and fourth cylinders and between the second and third cylinders while the balance ratios k_L and k_R of half crank webs are symmetrical between two arbitrary combined cylinders.

10. The in-line four-cylinder engine in Claim 1, wherein the primary balancer is provided parallel to the crankshaft, and balance weight is provided at a location opposite to the crank pins of the second and third cylinders or at a location opposite to the crank pins of the first and fourth cylinders.

11. A vehicle provided with the in-line four-cylinder engine for a vehicle according to Claim 1.